

What's Going On?

Checking In

Minds on

What's my Domain and Range?

Action!

What's my actual Domain and Range?

Consolidation Domain and Range of Functions

Learning Goal - I will be able to determine the domain and range of relations and functions from graphs and equations.

What's happening at

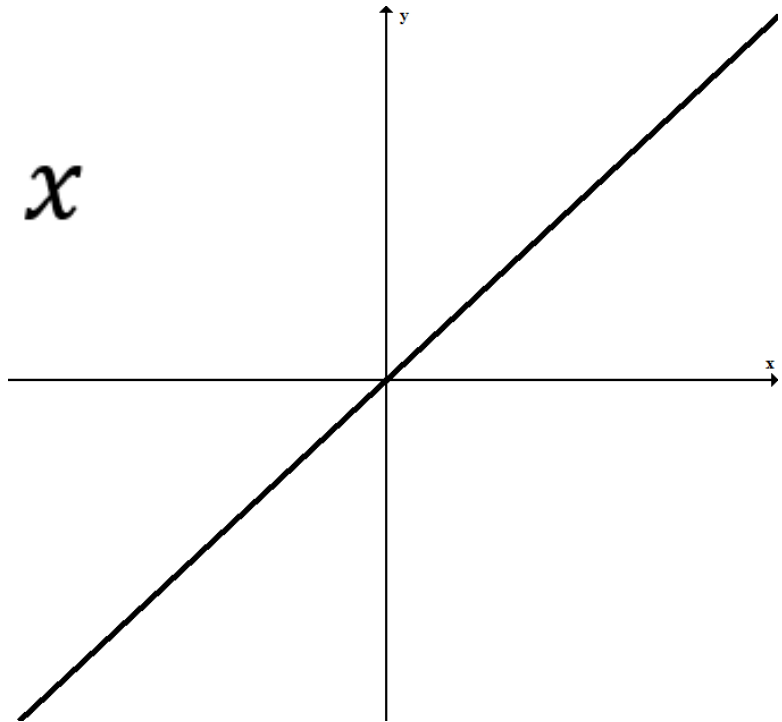
gilbertmath.com?

Checking In

Finishing Up Yesterday

Linear Function

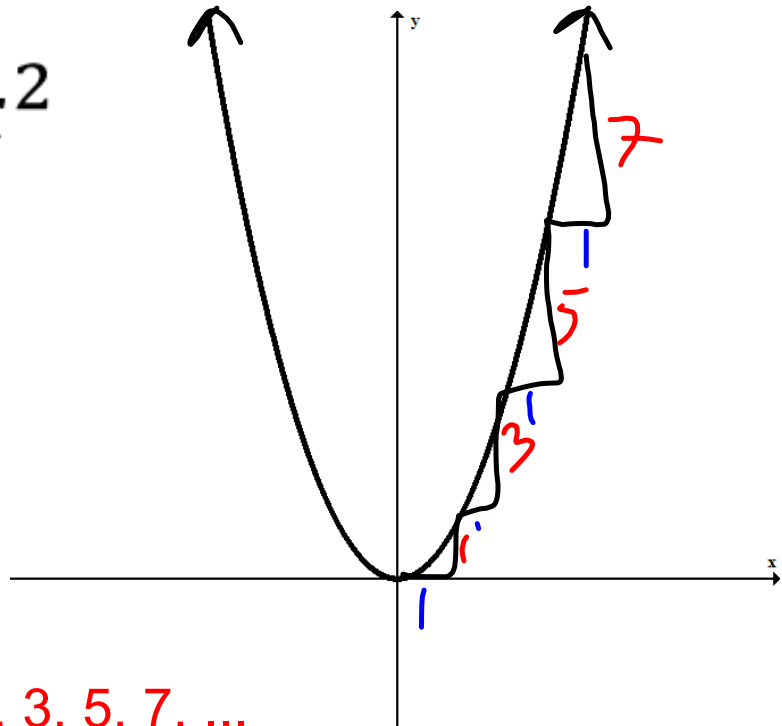
$$f(x) = x$$



- it's a line!
- goes through the origin
- slope of 1 (m)
- y-intercept of 0 (b)
- x-intercept of 0
- $y=mx+b$ form is $y = 1x + 0$

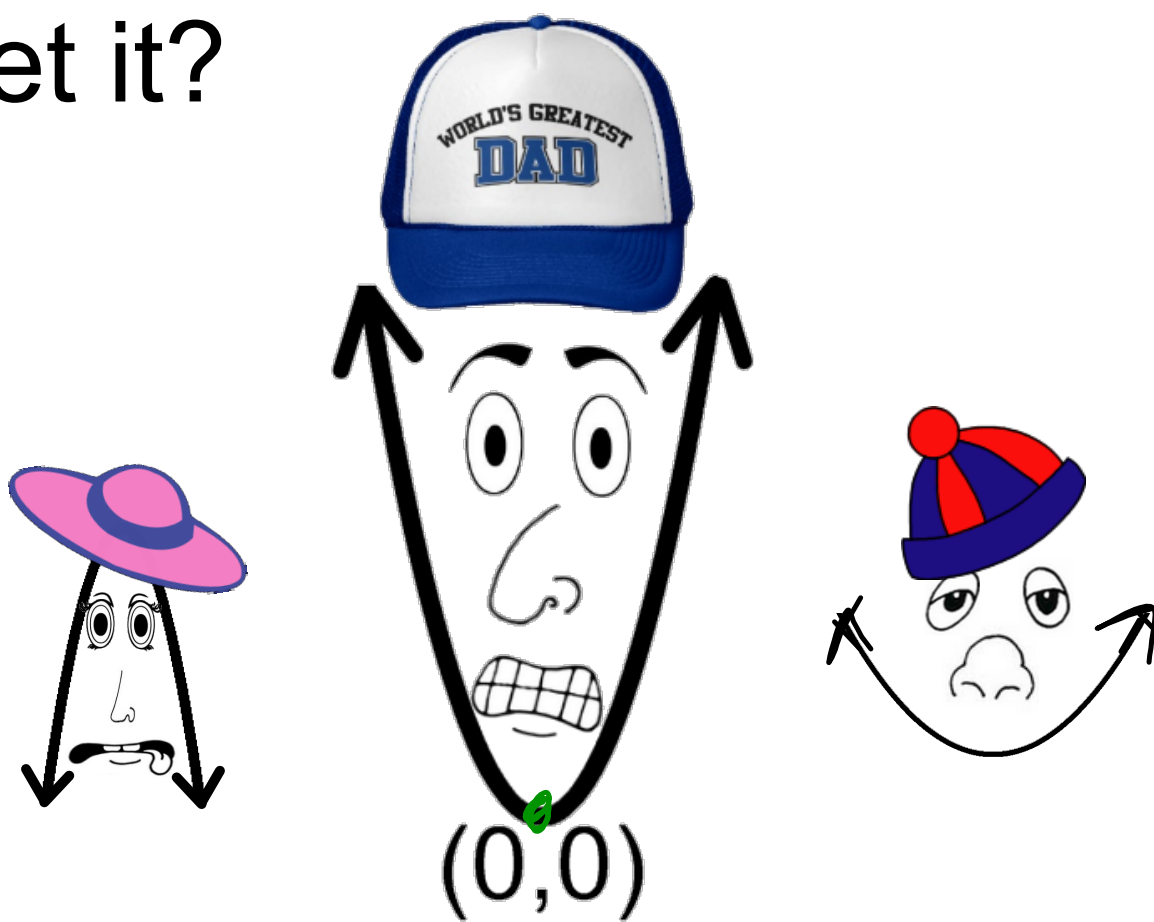
Quadratic Function

$$f(x) = x^2$$

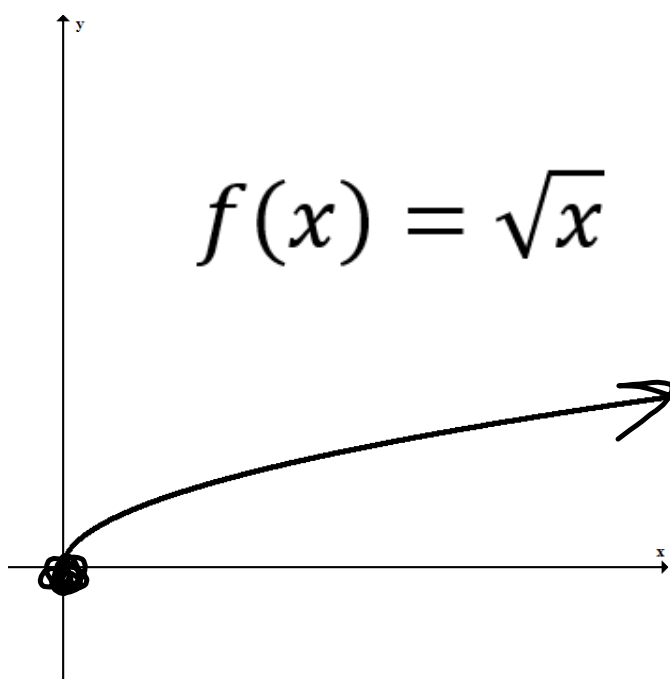


- it's a parabola
- opens up
- vertex at $(0, 0)$
- step pattern is 1, 3, 5, 7, ...
- x and y-intercepts are both 0
- in vertex form $y = a(x - h)^2 + k \rightarrow y = x^2$
 $a = 1, h = 0, k = 0$
- the curve has not been stretched or compressed
- has a minimum but no maximum

Get it?



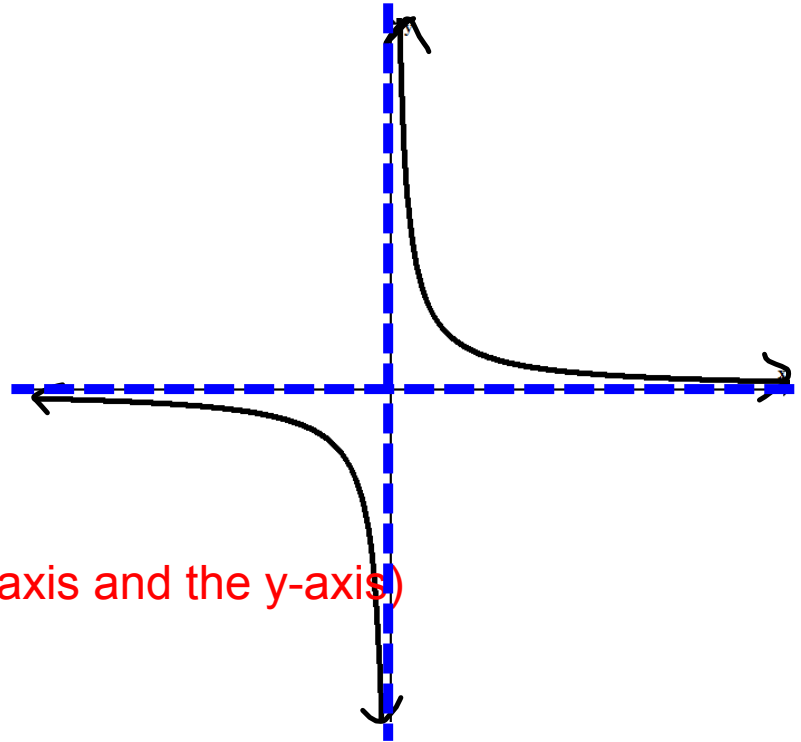
Square Root Function



- starts at (0,0)
- x is always positive or 0
- y is always positive or 0
- when $x = 1$, $y = 1$
- increasing from left to right
- growth slows down

Reciprocal Function

$$f(x) = \frac{1}{x}$$



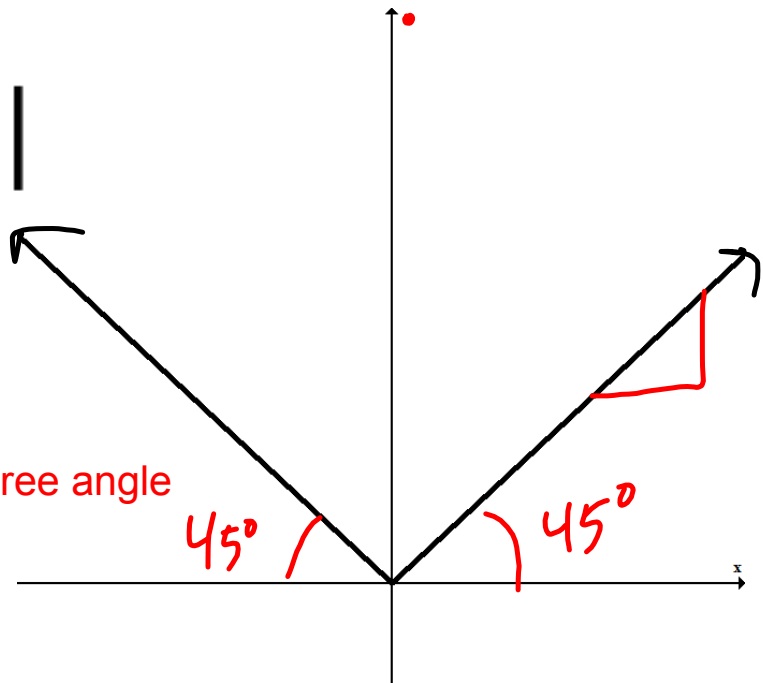
- two asymptotes (the x-axis and the y-axis)
 - $x = 0$ and $y = 0$
- When x is POSITIVE
 - as $|x|$ increases, $f(x)$ decreases (approaches zero)
 - as $|x|$ decreases, $f(x)$ increases (approaches infinity)
- When x is NEGATIVE
 - as $|x|$ increases, $f(x)$ decreases (approaches zero)
 - as $|x|$ decreases, $f(x)$ increases (approaches negative infinity)

Absolute Value Function

$$f(x) = |x|$$



- only in quadrants I and II
- starts at (0,0)
- both parts are at a 45 degree angle to the horizontal
- slope of right side is 1
- slope of left side is -1
- $f(x) = f(-x)$ for any x
- $f(x)$ is always POSITIVE or ZERO



Minds on

What's my Domain and Range?

NEW TERM

The domain of a relation is the set of all values of the independent variable.

(all possible x-values)

NEW TERM

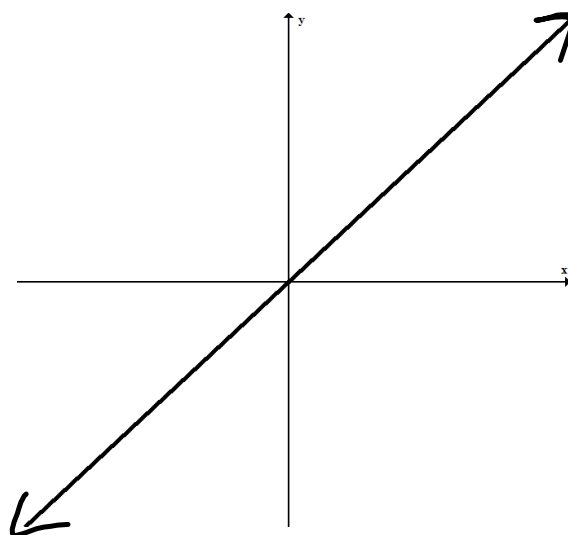
The range of a relation is the set of all values of the dependent variable.

(all possible y-values)

Minds on

What's my Domain and Range?

$$f(x) = x$$

**Domain**

anything & everything

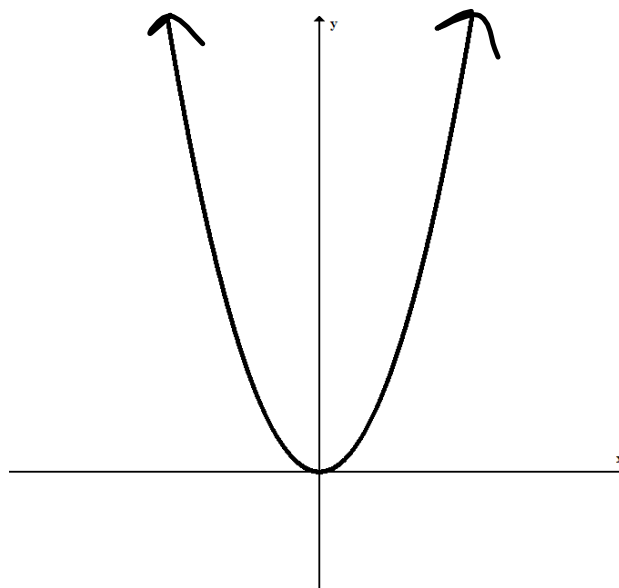
Range

anything & everything

Minds on

What's my Domain and Range?

$$f(x) = x^2$$

**Domain**

anything + everything

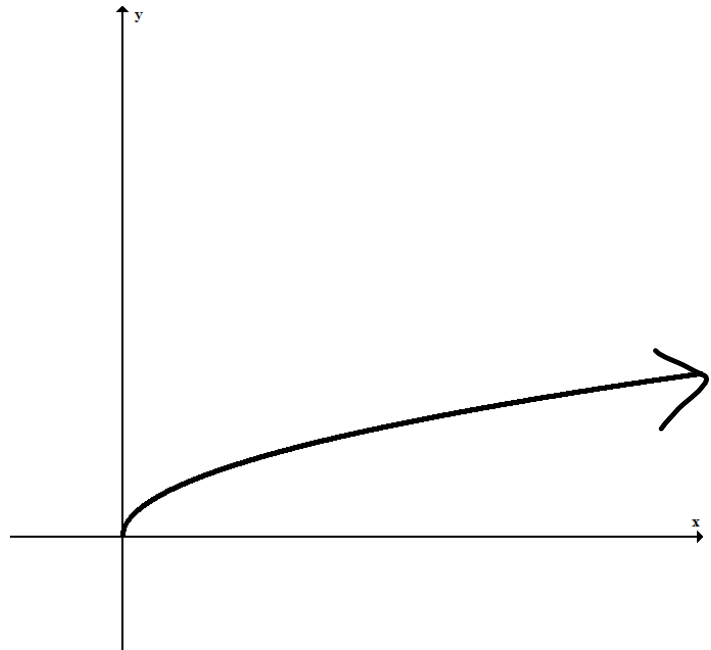
Range

anything 0 or greater

Minds on

What's my Domain and Range?

$$f(x) = \sqrt{x}$$

**Domain**

Anything 0 or greater

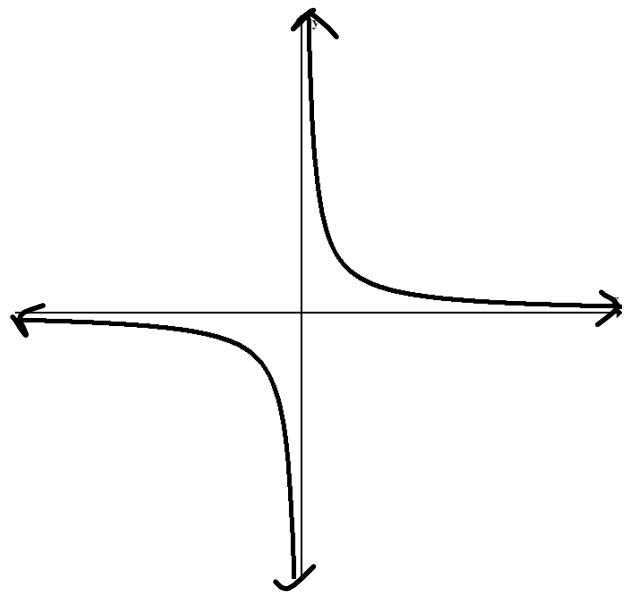
Range

Anything 0 or greater

Minds on

What's my Domain and Range?

$$f(x) = \frac{1}{x}$$



Domain

Anything except 0

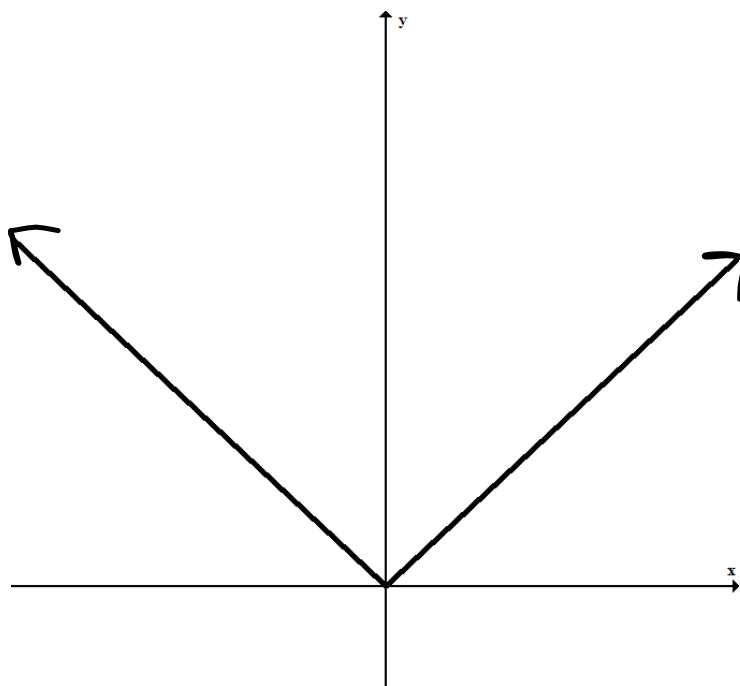
Range

Anything except 0

Minds on

What's my Domain and Range?

$$f(x) = |x|$$

**Domain**

anything & everything

Range

anything 0 or greater

Action!

Domain and Range

First, number systems!

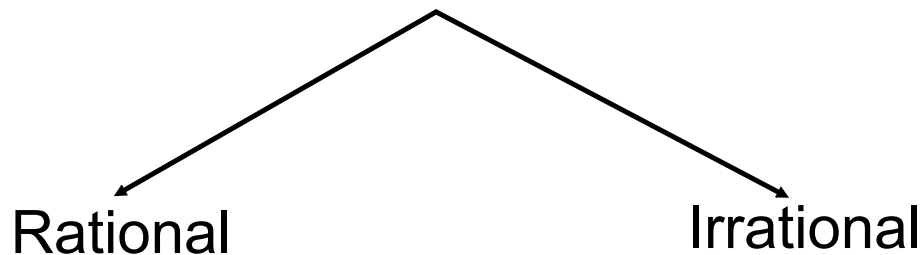
NEW TERM

Real Numbers:

Numbers that are either rational or irrational; these include positive and negative integers, zero, fractions, and irrational numbers such as $\sqrt{2}$ and π .

Action!

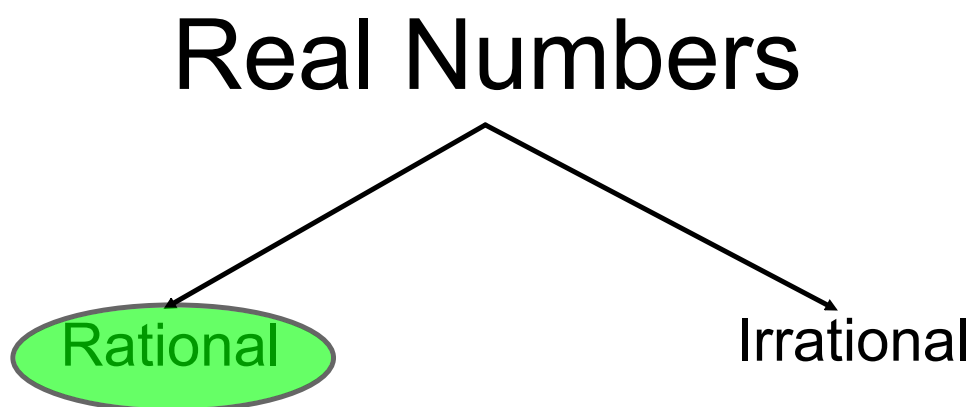
Real Numbers



Real numbers are either Rational or Irrational

An irrational number is any number that CANNOT be represented as a fraction of two integers.

Action!



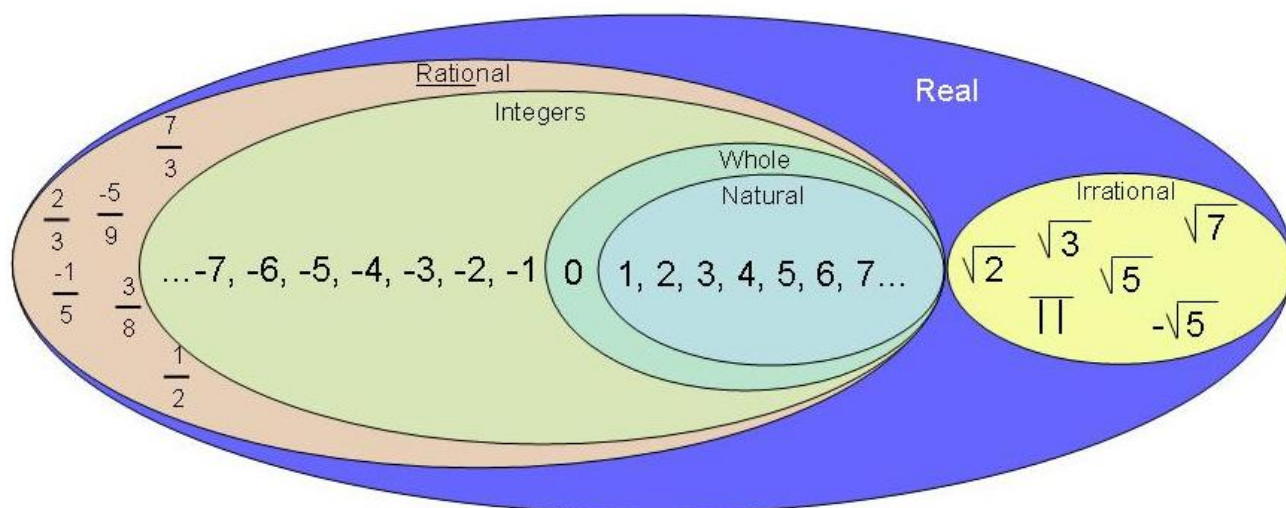
Rational Numbers include all *integer fractions*, integers, whole numbers and natural numbers.

All natural numbers are whole numbers.

All whole numbers are integers.

All integers are rational.

Action!



Set Notation

"a member of"
"is a"
"but"

$$\{x \in \mathbb{R} \mid x \geq 0\}$$

x
is an element of

the real numbers

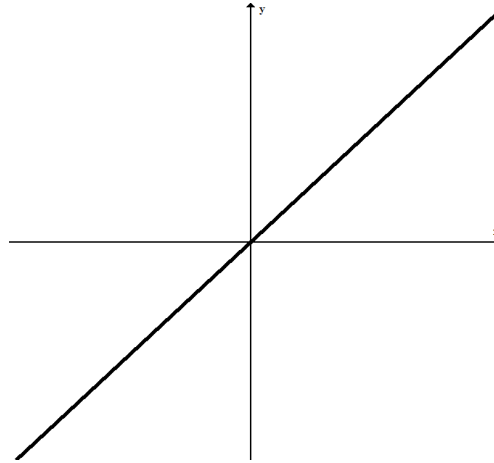
such that

x is greater than or equal to 0

Action!

What's my actual Domain and Range?

$$f(x) = x$$



Domain "anything and everything"

$$\{x \in \mathbb{R}\}$$

"x is a member of the real numbers... no restrictions!"

Range "anything and everything"

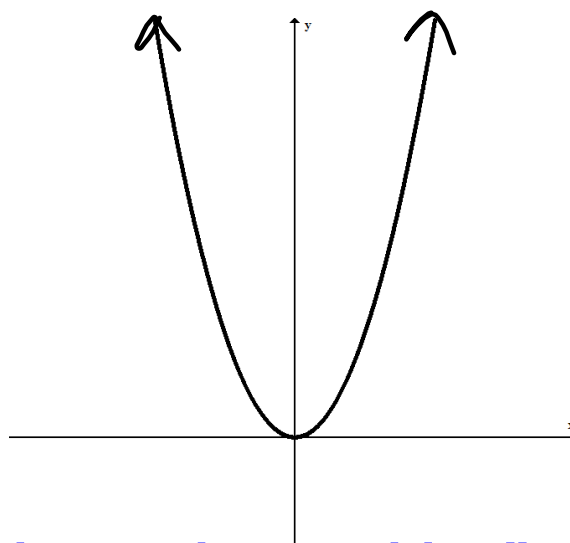
$$\{f(x) \in \mathbb{R}\}$$

"f of x is a member of the real numbers... no restrictions!"

Action!

What's my actual Domain and Range?

$$f(x) = x^2$$



Domain "anything and everything"

$$\{x \in \mathbb{R}\}$$

"x is a member of the real numbers... no restrictions!"

Range "anything 0 or greater"

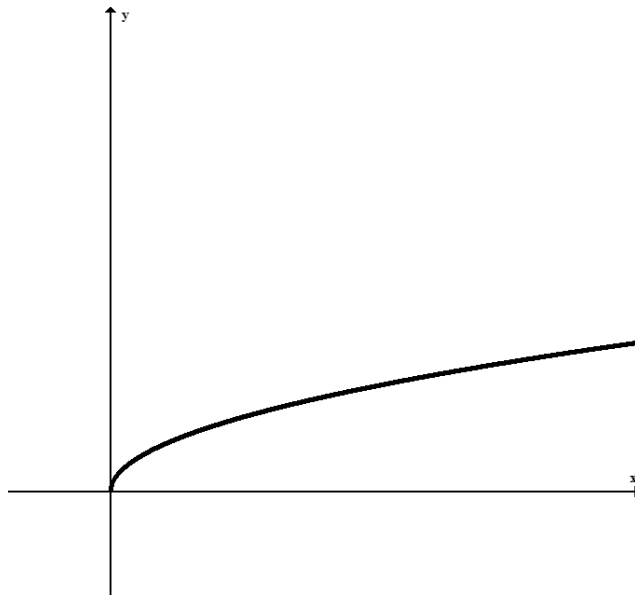
$$\{f(x) \in \mathbb{R} \mid f(x) \geq 0\}$$

"f of x is a member of the real numbers, and it is always greater than or equal to zero."

Action!

What's my actual Domain and Range?

$$f(x) = \sqrt{x}$$



Domain "anything 0 or greater"

$$\{x \in \mathbb{R} \mid x \geq 0\}$$

"x is a member of the real numbers, and it is always greater than 0."

Range "anything 0 or greater"

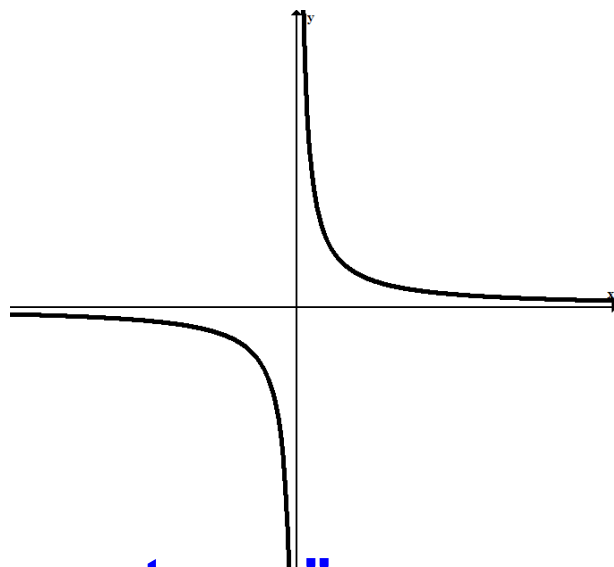
$$\{f(x) \in \mathbb{R} \mid f(x) \geq 0\}$$

"f of x is a member of the real numbers, and it is always greater than or equal to zero."

Action!

What's my actual Domain and Range?

$$f(x) = \frac{1}{x}$$



Domain "anything except zero"

$$\{x \in \mathbb{R} \mid x \neq 0\}$$

"x is a member of the real numbers, but it's not zero."

Range "anything except zero"

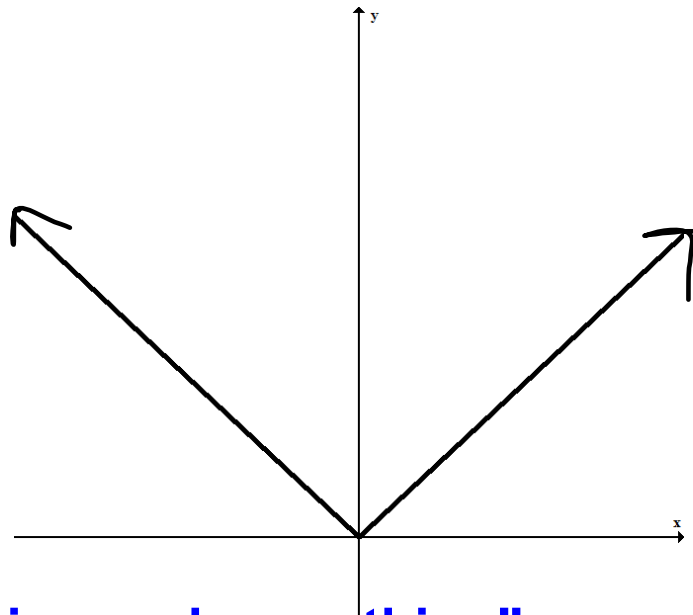
$$\{f(x) \in \mathbb{R} \mid f(x) \neq 0\}$$

"f of x is a member of the real numbers, but it's not zero."

Action!

What's my actual Domain and Range?

$$f(x) = |x|$$



Domain "anything and everything"

$$\{x \in \mathbb{R}\}$$

"x is a member of the real numbers, no restrictions."

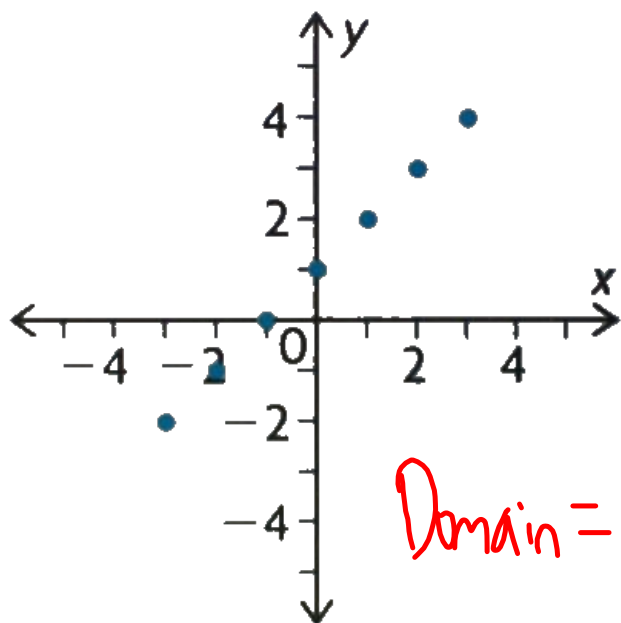
Range "anything 0 or greater"

$$\{f(x) \in \mathbb{R} \mid f(x) \geq 0\}$$

"f of x is a member of the real numbers, and it is always greater than or equal to zero."

Action!

Domain and Range

**WHITEBOARDS!**Domain

$$\text{Domain} = \{-3, -2, -1, 0, 1, 2, 3\}$$

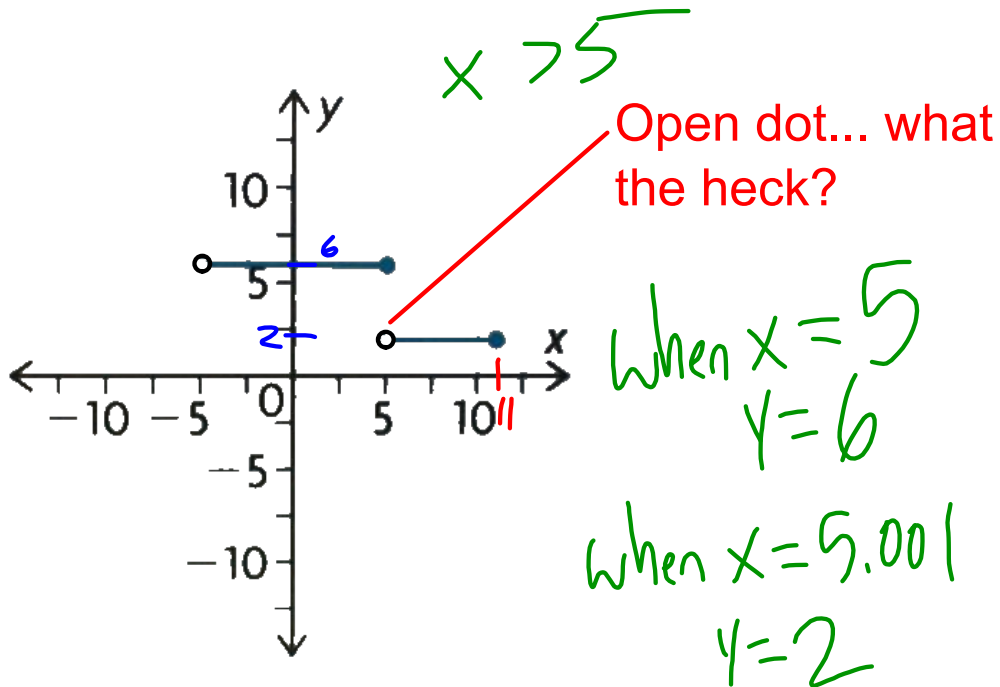
$$\text{Range} = \{-2, -1, 0, 1, 2, 3, 4\}$$

In this example, we don't actually have a line, we just have individual points. So, we just write the domain and range as a list of values.

Action!

Domain and Range

b)



In this graph, we have a situation where y is 6 when x is greater than -5 and less than or equal to 5 . When x is greater than 5 , and less than or equal to 10 , y is 2 .

domain

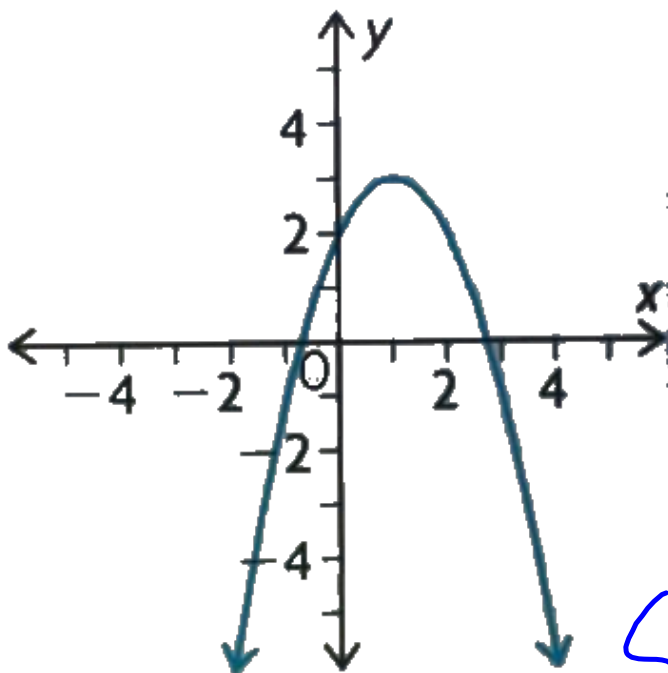
$$\{x \in \mathbb{R} \mid -5 < x \leq 10\}$$

range

$$\{2, 6\}$$

Action!

Domain and Range



Domain
 $\{x \in \mathbb{R}\}$

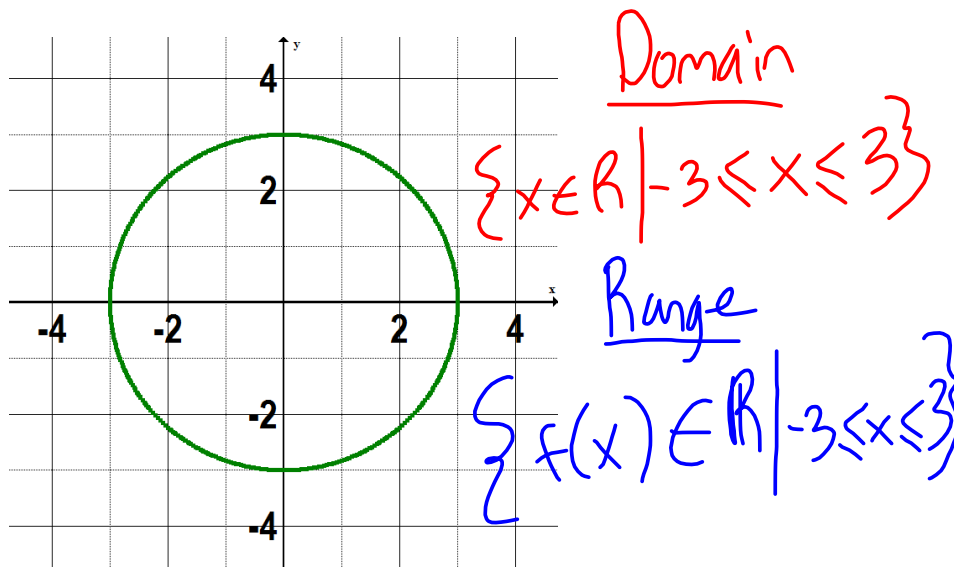
Range

$\{f(x) \in \mathbb{R} \mid f(x) \leq 3\}$

Range: f of x is a real number, and it is always less than or equal to 3. This is because the vertex is at 3 and the graph decreases.

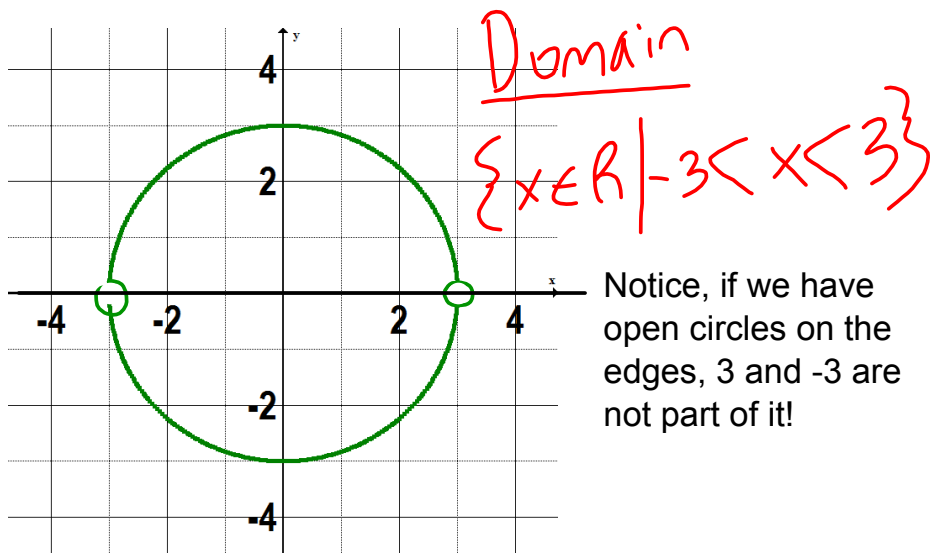
Action!

Domain and Range



For the domain, x is anything between -3 and 3 (including both 3 and -3)

For the range, $f(x)$ is anything between -3 and 3 (including both 3 and -3)



In this case, x is anything between -3 and 3 and this time, it doesn't include 3 !

The range in this case is anything between -3 and 3 INCLUDING both! BUT notice that the graph doesn't exist when $f(x) = 0$.

Consolidation

Domain and Range

a) $f(x) = 2x - 3$

Function?

Oh yeah! It's a line :)

Parent Function: $f(x) = x$ of course**Domain =**

anything!

$\{x \in \mathbb{R}\}$

Range =

anything!

$\{f(x) \in \mathbb{R}\}$

Consolidation

Domain and Range

b) $g(x) = -3(x + 1)^2 + 6$

Function?

yep! It's a quadratic!

Parent Function:

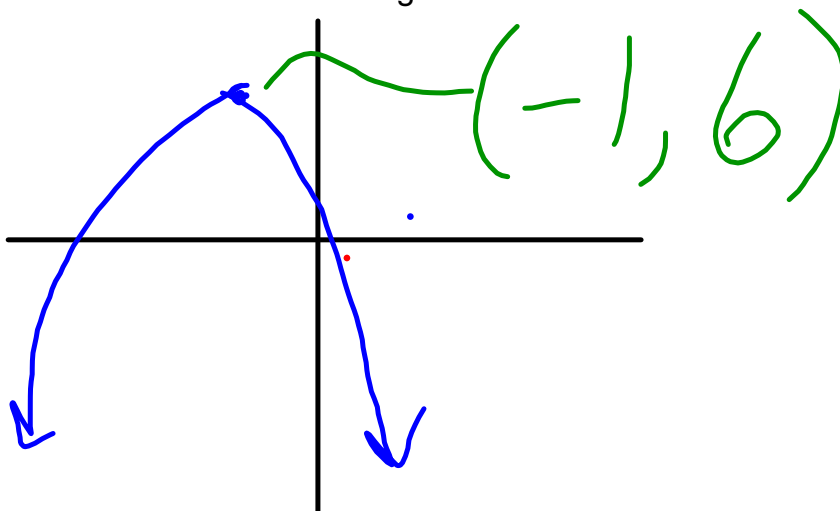
$$y = x^2$$

$$\text{Domain} = \{x \in \mathbb{R}\}$$

Well... it's a parabola, so it continues forever in both directions.

$$\text{Range} = \{f(x) \in \mathbb{R} \mid f(x) \leq 6\}$$

Well... its a-value is -3, so it's been flipped upside down. Also, its k-value is +6 so its vertex is up at 6. This means it starts at 6 and goes down forever.



Consolidation

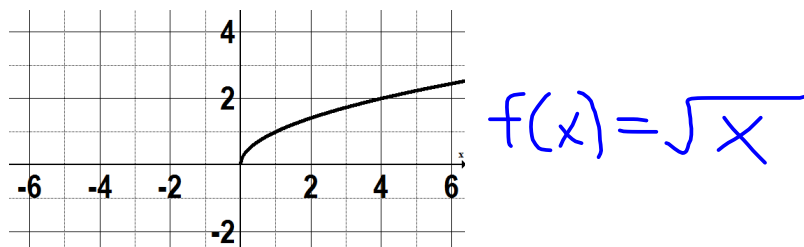
Domain and Range

c) $h(x) = \sqrt{x+5}$

Function?

Yep! It's a square root function.

Parent Function:



Domain =

Hmm.... I know that the domain of the parent function is $x \geq 0$. But this isn't quite the same... I also know that we can't take the root of a negative number. So this means that $x+5$ has to be greater than or equal to 0.

Maybe I'll write that as an equation and solve for x .

$$\begin{array}{r}
 x + 5 \geq 0 \\
 \underline{-5 \quad -5} \\
 x \geq -5
 \end{array}
 \quad \text{ooooo} \quad +$$

So the domain is $\{x \in \mathbb{R} \mid x \geq -5\}$

Range =

Hmm... well since x is greater than or equal to -5 . Our lowest y -value will be the square root of $(x+5)$ or $(-5+5)$ which is 0. Then the y -values just increase!

So just like the parent function, the range is:

$$\{f(x) \in \mathbb{R} \mid f(x) \geq 0\}$$

Consolidation

Homework!

gilbertmath.com